Discrete Mathematics

Discrete Mathematics introduces students to the mathematics of networks, social choice, and decision making. The course extends students' application of matrix arithmetic and probability. Applications and modeling are central to this course of study. Appropriate technology, from manipulatives to calculators and application software, should be used regularly for instruction and assessment.

Prerequisites
- Describe phenomena as functions graphically, algebraically and verbally; identify independent and dependent quantities, domain, and range, input/output, mapping.
- Translate among graphic, algebraic, numeric, tabular, and verbal representations of relations.
- Define and use linear and exponential functions to model and solve problems.
- Operate with matrices to model and solve problems.
- Define complex numbers and perform basic operations with them.

Strands: Number and Operations, Geometry and Measurement, Data Analysis and Probability, Algebra

COMPETENCY GOAL 1: The learner will use matrices and graphs to model relationships and solve problems.

Objectives

1.01 Use matrices to model and solve problems.
  a) Display and interpret data.
  b) Write and evaluate matrix expressions to solve problems.
1.02 Use graph theory to model relationships and solve problems.

COMPETENCY GOAL 2: The learner will analyze data and apply probability concepts to solve problems.

Objectives

2.01 Describe data to solve problems.
   a) Apply and compare methods of data collection.
   b) Apply statistical principles and methods in sample surveys.
   c) Determine measures of central tendency and spread.
   d) Recognize, define, and use the normal distribution curve.
   e) Interpret graphical displays of data.
   f) Compare distributions of data.

2.02 Use theoretical and experimental probability to model and solve problems.
   a) Use addition and multiplication principles.
   b) Calculate and apply permutations and combinations.
   c) Create and use simulations for probability models.
   d) Find expected values and determine fairness.
   e) Identify and use discrete random variables to solve problems.
   f) Apply the Binomial Theorem.

2.03 Model and solve problems involving fair outcomes:
   a) Apportionment.
   b) Election Theory.
   c) Voting Power.
   d) Fair Division.

COMPETENCY GOAL 3: The learner will describe and use recursively-defined relationships to solve problems.

Objective

3.01 Use recursion to model and solve problems.
   a) Find the sum of a finite sequence.
   b) Find the sum of an infinite sequence.
   c) Determine whether a given series converges or diverges.
   d) Write explicit definitions using iterative processes, including finite differences and arithmetic and geometric formulas.
   e) Verify an explicit definition with inductive proof.